Space Weather Technical Forecast

Issued on Monday, 25 October 2021 at 13:06 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Daily Slight Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was Very Low through the period, with only B-class flares observed. There are currently three sunspot regions on the visible disc. The first, AR2886 is a simple unipolar Hsx/Alpha group in the southwest quadrant, which remains stable and inactive. The second, AR2887, which is larger and more magnetically complex, and is currently a single spot group, but almost appears as a pair of sunspots, although their plage regions and magnetic fields are intertwined. This is currently classified as a Dki/Beta-Gamma, with further development in its intermediate spots. The third spot, AR2888, has recently rotated onto the southeast limb and is currently a simple Axx/Alpha, which will continue to be monitored for any further development. To the south of AR2888, there is a plage region, which shows some pores developing, this will continue to be monitored for any emerging sunspots. There has recently been a prominence/filament eruption observed in the southeast quadrant near a plage area south of AR2888, which can be seen in SDO/AIA 304, with a CME emerging in STEREO-A imagery, which given its location is unlikely to be Earth-directed - this yet to be analysed. No Earth-directed CMEs have been observed in current imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1, was at background levels throughout, ranging between 300 km/s to 380 km/s. The solar wind density was initially average, with a peak around 10ppcc, then fell to below average from 24/1900UTC. The IMF Bt was weak, at 6nT or below, and the north-south component was subsequently weak ranging from -3/+5 Bt. The phi angle remained predominantly negative (towards the sun). Resultant geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) as measured by GOES-16 was at Background levels, with no solar radiation storms observed. High energy electron flux (greater than 2MeV) was predominantly at background levels. Associated 24-hour electron fluence was well below the Active (1e8 integrated pfu) threshold, with 1.36e6 integrated pfu recorded at 25/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily Slight Chance of M-class flares, largely the result of the complexity of AR2887, although this has yet to be borne out in observed X-ray activity. There is a possible returning region just over the northeast limb that may yet increase probabilities over the next few days, however these do not yet feature in the percentages.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs feature in this forecast period. CH15/+ is expected to become geoeffective sometime late on Day 3 (27th) or early on Day 4 (28th). Due to its positive orientation and given it remains connected to the northern polar crown, an slight enhancement of solar wind speed is possible, perhaps bringing brief Unsettled or Active intervals on Days 3 or 4 in an otherwise Quiet geomagnetic period.

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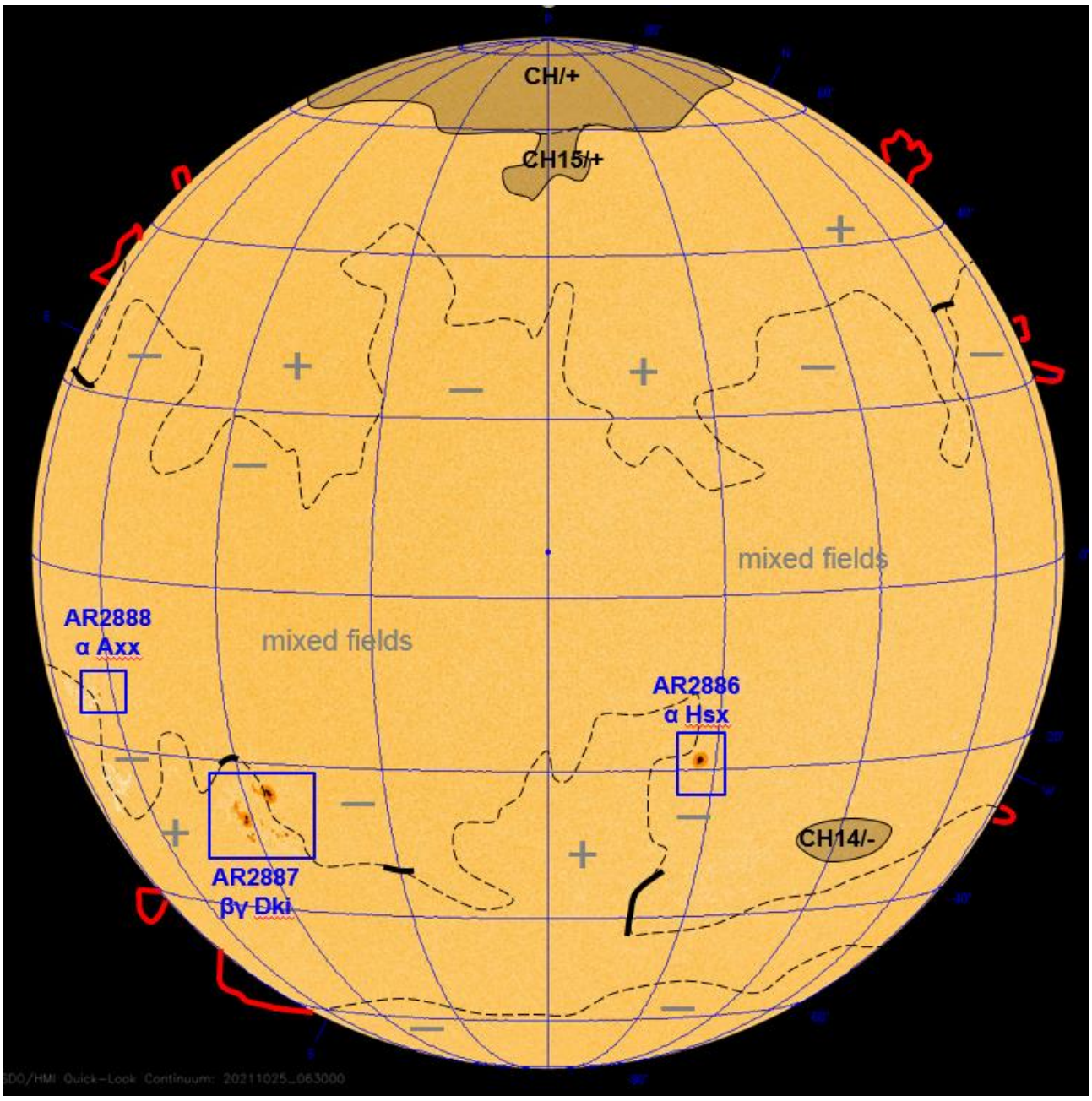
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels, with no solar radiation storms currently expected. The high energy electron flux (greater than 2MeV) is likely to remain at Normal Background levels, with the 24-hour fluence expected to remain well below Active.

Figure 1. Solar Analysis Valid 25/0630UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are expected during the period. CH15/+, a southern extension of the northern polar crown, is expected to become geoeffective sometime late on day 3 (27th) or early day 4 (28th). STEREO A PLASTIC data measurements 3 days ago show a slow solar wind environment for the period, there are several gaps within the data, with the possibility that CH15/+ may bring a slight enhancement to solar winds, perhaps bringing a chance of Unsettled or Active intervals. The risk of any minor geomagnetic storms remains at nominal levels through the period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	3	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Prominence/filament eruption in the southeast quadrant observed on SDO/AIA 304 and STEREO-A imagery from 25/0900UTC. This is yet to be analysed, but given its location it is unlikely to have any Earth-directed component.

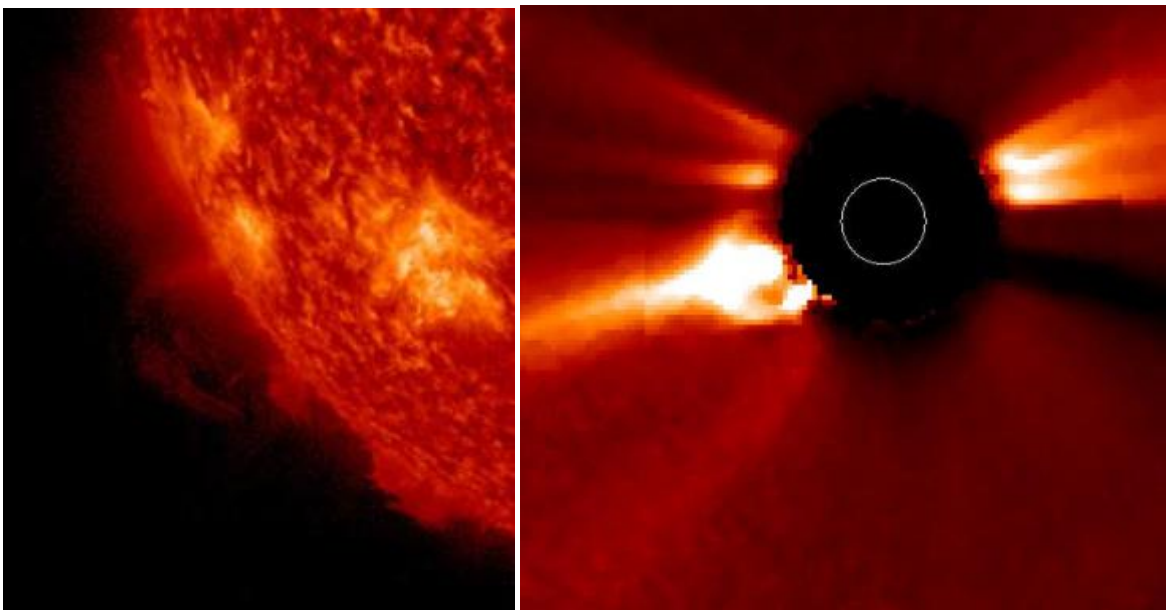

Figure 3: MOSWOC Persistence Model – showing a possible enhancement in solar wind speeds due to possible connection with CH15/+ on days 3 and 4 (27 and 28 Oct).

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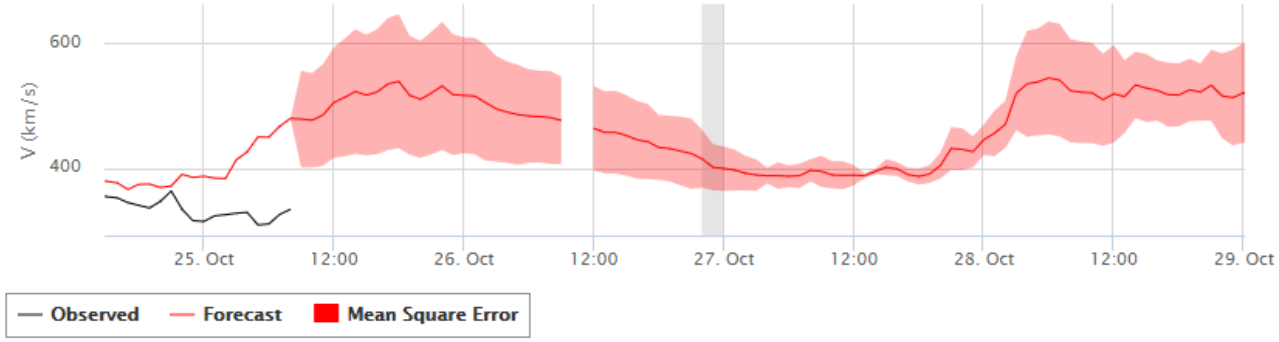

Radio Blackouts - X-Ray Flares:

There is a daily Slight Chance of M-class flares. This is largely the result of sunspot region AR2887 in the southeast quadrant, which currently is assessed as a Dki/Beta-gamma complexity and continues to show a slight growing trend. The prospects for significant X-ray activity may increase later in the period however, as there is a bright flux region lying to the northeast limb which has been the subject of several CME's over the past few days. This may increase the flare risk as it rotates onto the visible disk in the next couple of days. The risk of significant flares is held at a daily Slight Chance for M-class and a non-zero risk of X-class due to AR2887 alone.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 4: GOES-16 X-ray flares.

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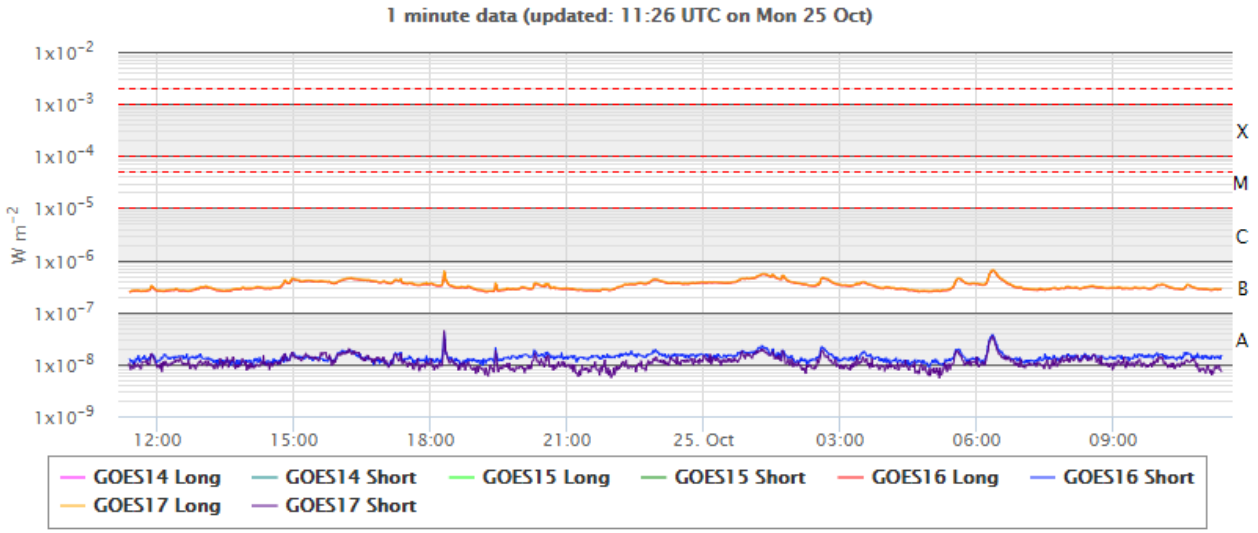
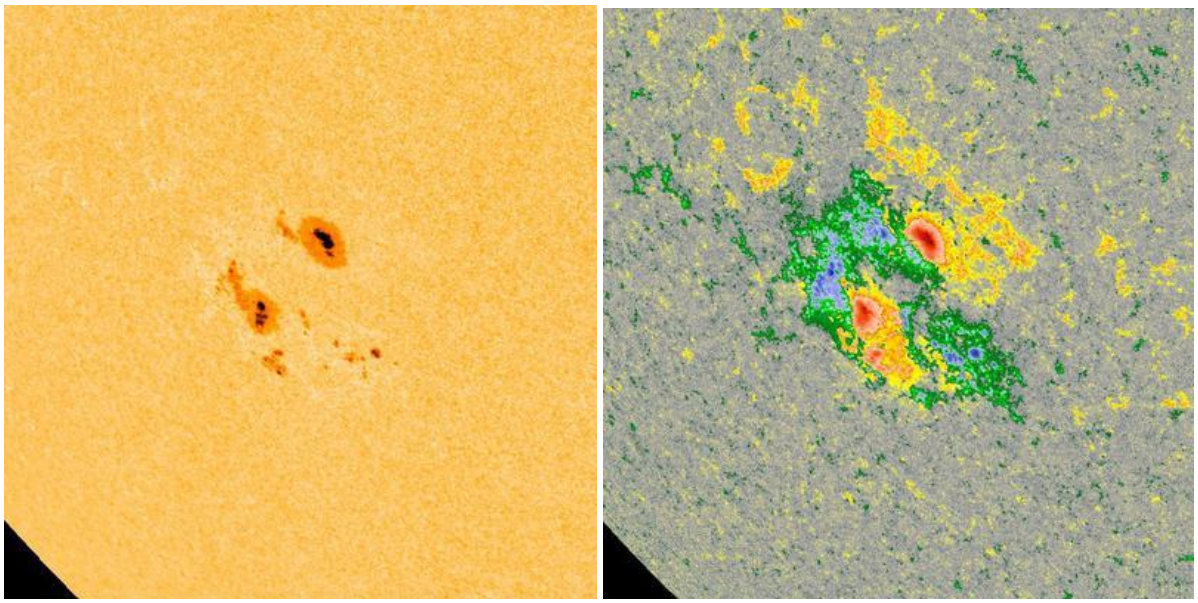


Figure 5: Intensitygram and magnetogram imagery showing the magnetic complexity of AR2887.



Solar Radiation Storms - (High Energy Protons):
With no significant sunspots in geoeffective positions on the Sun, solar radiation storms are currently not expected.

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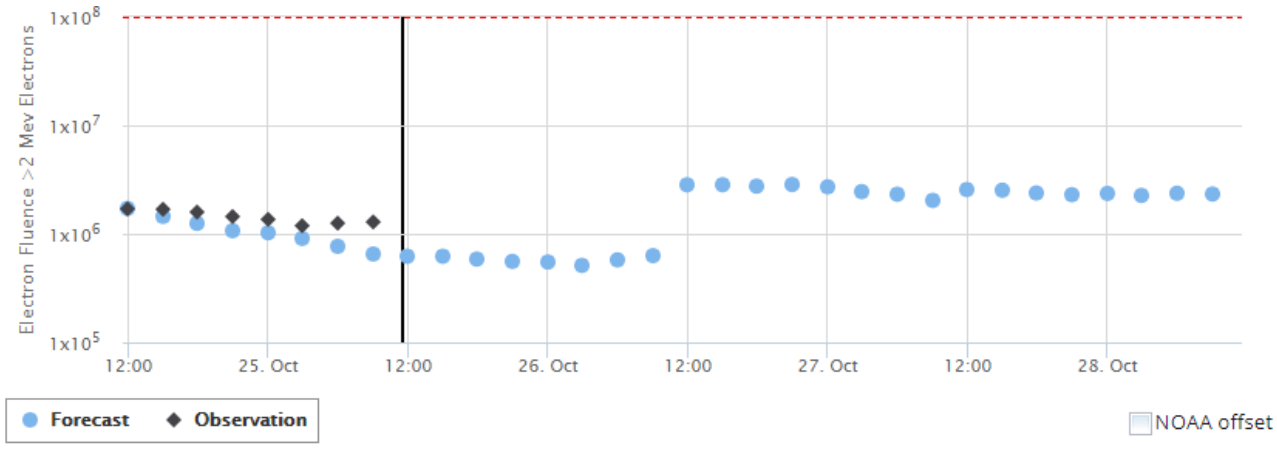
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is currently at Normal Background levels, with no further enhancements expected in the four-day forecast period sub-Active fluence should persist throughout.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 6: REFM observations and forecast for electron fluence – well below active threshold throughout.



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